Liver transplantation and adolescence: the role of mental health

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Abstract

Young people (YP) with chronic illness have higher rates of mental health problems than the general population, with psychosocial complexity associated with non-adherence (NA) and poorer health outcomes. This study aimed to describe the prevalence of anxiety and depression in YP post-liver transplant (LT), with autoimmune liver disease (AILD) and other chronic liver diseases, identify the factors YP attribute their distress to and the relationship between anxiety/depression, and describe YP's beliefs about their illness and treatment. An electronically-administered questionnaire battery was given routinely to YP attending an outpatient liver transition clinic. 187 YP participated, of which 17.7% screened positive for anxiety or depression. There were no significant differences between disease groups. This is significantly higher than the prevalence of common mental health problems in the general adolescent population. Patients most frequently attributed their distress to fatigue, sleep difficulties, financial concerns, problems at work/school, worry and low self-esteem. Higher levels of depression and anxiety were significantly associated with specific illness and treatment beliefs, but not with perceived understanding of illness or treatment control. In conclusion, the increased prevalence of mental health problems in this population and the intertwined nature of these with their physical health outcomes provide evidence that holistic care should be delivered as standard for this age group.

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Introduction

Adolescents have inferior graft-survival rates than younger children and adults across all solid organ transplant groups (1). This appears to be partially attributable to the high rates of non-adherence (NA) to medication which is highly prevalent amongst this age group and during transition into adult services (2). Adolescence is also the peak time for the onset of mental health problems, with up to 6% of 11-15 year olds in the UK estimated to have a diagnosable mental health problem (3). Rates of anxiety, depression and behavioural difficulties are further elevated in children and adolescents with physical health problems (4-6). Specialised health programmes aimed at addressing the needs of young people (YP) during transition from paediatric to adult services have shown improvement of patient and graft survival in the transplant setting (7-8). However, it is unclear whether these programmes can also play a role in decreasing the risk of decompensation and need for transplantation in liver conditions such as autoimmune liver disease (AILD). A diagnosis of AILD between the ages of 14-20 years has been found to be independently predictive of liver-related death or need for liver transplantation compared to other age groups (9). In view of organ shortages, avoiding transplantation in these YP should be a priority. The focus on minimising NA in AILD aims to prevent avoidable transplantation, and in post LT aims to reduce graft loss, yet research and clinical care is often conducted separately for these populations. Other disease groups are seen in smaller numbers so are more difficult to conduct research in. Research is needed into whether these populations have different transitional health care needs so as to inform future clinical and research initiatives.

Adolescents (12-18 years) and YP (16-25 years) with adverse psychosocial circumstances are at particular risk of NA and poor health outcomes (10-11). A prospective study of twenty YP post liver transplant (LT; mean age 22 years) found that psychosocial distress was significantly associated with NA one year after transition into the adult service (12). This indicates that a better understanding of YP's mental health is required in order to improve

adherence management. To date there has been a paucity of studies which quantify the prevalence of common mental health problems amongst YP post LT or with AILD, or which compares these closely related illness groups to ascertain whether their needs are similar. Furthermore, little is known about the factors that are associated with YP's distress, and whether their beliefs about their illness and treatment play a role.

This study therefore aimed to identify, in a large cohort of YP (a) post LT, (b) with AILD and (c) other chronic liver diseases:

1) The prevalence rates of anxiety and depression
2) The factors YP attribute their distress to
3) The relationship between anxiety, depression and YP's beliefs about their illness and treatment
4) Whether (1), (2) and (3) differ across the three illness groups

Experimental Procedures

Participants

All YP attending the transition clinic at a tertiary liver centre in a London hospital between November 2013 and September 2015 contributed data to this analysis. The liver transition service is a multidisciplinary service dedicated to adolescents and YP, which aims to provide developmentally appropriate care and a smooth transition between the paediatric and adult service for YP with a range of liver conditions and post liver-transplant. The team includes consultant hepatologists, clinical nurse specialists, social workers and a clinical psychologist from across the paediatric and adult liver services. The service sees young people aged 16-25 years old, with a median age of 18 years old. The patients were divided in three groups: those who had undergone LT, those with AILD and others. Clinical data collected included

diagnosis, age at diagnosis and /or LT, baseline liver function tests at the time of screening (serum bilirubin micromol/l, aminoaspartate transferase (AST) IU/l, gamma-glutidyl transpeptidase (GGT) IU/l.

Methods

IMPARTS (Integrating Mental and Physical Healthcare: Research, Training and Services) web-based screening system is used to collect patient-reported outcomes as part of routine clinical practice, and provide real-time, tailored referral advice (13). IMPARTS has ethical approval for data collected via the screening interface to be used for research purposes (REC: 12-SC-0422).

Over the study period, implementation of IMPARTS was reliant on the availability of a hospital volunteer. All patients attending an outpatient appointment on the days that the volunteer was available during the study period were approached and given an information sheet explaining the purpose of screening. Patients then completed a series of electronically administered questionnaires using a tablet. This is a highly acceptable and feasible approach, data on which will be presented in a separate paper (Hames, unpublished data). As part of clinical practice, all YP screening positive for pMDD or pGAD were offered a referral to the Clinical Psychologist (CP). Agreement between the positive screen and the CP's clinical judgement was recorded for the first 20 patients who screened positive for pMDD or pGAD.

Measures

The IMPARTS system contains a core set of measures, including the Patient Health Questionnaire (PHQ9) (14) and the Generalized Anxiety Questionnaire (GAD7) (15). The liver transition battery additionally includes the Brief Illness Perception Questionnaire (BIPQ) (16) and a modified distress thermometer (17). Outcome measurements were branched to

make them as short as possible and reduce clinical burden. The measures have robust psychometric properties and have been successfully used in adolescent populations.

Depression

The PHQ9 has good psychometric qualities and is recommended by the National Institute for Health and Care Excellence for measurement of depression in patients with chronic physical health conditions (18). It has been found to have similar sensitivity and specificity in use with adolescents (19). Probable major depressive disorder (pMDD) was defined as scoring "more than half the days" or "nearly every day" on at least one of the first two items of the PHQ9 (low mood and a loss of interest in activities) and on at least five out of all nine symptoms within the last two weeks. Item nine ("Thoughts that you would be better off dead or of hurting yourself in some way") assessed suicidality, with scores of "more than half the days" or more indicating suicidal ideation. Patients who did not respond positively to the first two items, essential for pMDD diagnosis, did not receive the full questionnaire and were classified as having "no symptoms". Patients completing the full questionnaire and not meeting criteria for pMDD were classed as having "some symptoms". This categorical algorithm has an 83% (95%CI: 72-91) sensitivity and 90% (95%CI: 87-93) specificity for detecting cases of pMDD (20). Patients with pMDD were further categorized into those experiencing mild symptom severity (PHQ9 <15), moderate symptom severity (PHQ9 15-19) and severe symptom severity (PHQ9 20-27) (21).

Anxiety

The GAD7 has good reliability, sensitivity and specificity, as well as criterion, construct, factorial and procedural validity (15). A score of 10 or more on the GAD7 was used to identify cases of probable Generalised Anxiety Disorder (pGAD), and scores ranging 5-9 indicated the presence of some anxiety symptoms.

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Beliefs about Illness

The 9-item BIPQ assesses illness beliefs along five dimensions (identity, cause, consequences, timeline and cure-control).The questionnaire asks patients to respond to questions using a 1-10 Likert scale, with each item mapping onto a separate factor. For example, *Consequences:* 'how much does your illness affect your life? 0 (no affect at all) to 10 (severely affects my life)', *Treatment Control:* 'how much do you think your treatment can help your illness? 0(not at all) to 10 (extremely helpful), *Emotional Response*: How much does your condition affect you emotionally? 0 (not at all) to 10 (extremely). The measure has robust psychometric qualities (16) and has been found to predict health behaviours in numerous conditions, including adherence to medication in adolescents and YP (22).

Psychological Distress Thermometer

The distress thermometer (DT) is a screening questionnaire widely used in oncology care to capture a patient's level of distress and the factors contributing to it (17). The DT and its cut-off scores have been validated in several adult cancer populations (23) and its use is recommended as part of routine care for teenagers and young adults with cancer (24). The DT was adapted for use in YP with liver disease by the clinical team, adjusting the problem list to include areas most commonly affected by liver disease, and piloted with 10 YP. The measure asks YP to rate their distress on a visual analogue scale (of a thermometer) from 0 (none) to 10 (lots) how 'worried or upset you have been feeling about things over the past week, including today'. They are then asked to identify 'which of the following the worry or upset is mostly about' and asked to select the relevant items from a problem list. The problems are organised into domains of Practical Issues, Lifestyle, Emotional Problems and Physical Problems, with a free text box for any problem not included. Interpretation was restricted to the problem list rather than the numerical score, as the tool has not yet been validated in this population.

Statistical Methods

The prevalence of pMDD and pGAD were quantified as the proportion of patients screening positive according to the thresholds and cut-offs defined above, from baseline screening encounters. Responses to the distress thermometer items were also quantified and mean distress scores reported for the total sample as well as the three diagnostic groups.

Differences in continuous mental health data between the three patient groups were assessed using analysis of variance or Kruskal-Wallis test for data that were not normally distributed. Differences in categorical mental health data between the three patient groups were assessed by dummy coding the variables and using Chi-square tests.

For correlation analyses, continuous indicators of depression and anxiety severity were calculated using responses for items 1 and 2 of the PHQ9 and GAD7 respectively, creating a continuous measure from 0 (low symptom severity) to 6 (high symptom severity). This was done to take into account the branching mechanism in place to reduce questionnaire burden - all patients complete the first two items of these measures, whereas only those showing symptoms continue to complete the remaining items. Scores of depression and anxiety severity were correlated with BIPQ scores using pairwise correlation analyses, with r of <0.1 indicate a small effect size, 0.1-0.3 indicating small-medium effect size, 0.3-0.5 indicating medium-large effect size, and >0.5 indicating a large effect size (25).

Results

A total of 187 patients were screened, representing 82% of the total number of patients attending an outpatient appointment when screening was available. The mean age was 18 years (range 15-23 years), of which 53% were female. Limited patient time and problems

with the Wi-Fi connection were reported as the most common reasons for not screening a patient. There were no significant differences between those who were and were not screened in terms of age, gender or the proportion of patients who had a liver transplant (Table 1). As the distress thermometer was added to the questionnaire set after screening started, these data are only available for 182 (78.2%) of patients in total. Figure 1 illustrates the underlying liver disease of our patient population, overall 51 (27.3%) patients were post LT, 69 (36.9%) were AILD (autoimmune sclerosing cholangitis n=22) and 67 (35.8%) were categorised into the "other" group. After AILD, biliary atresia (BA) was the most common diagnosis in 35 patients with 21 patients transplanted and 14 alive with their native liver. Six patients were listed for LT at the time of screening (2 with AILD and 4 with BA). Three patients with BA were re-listed for LT, 4 others had been re-transplanted. The median age at LT was 4.2 years (range 0.07-20.6 years).

The prevalence of depression and anxiety

Table 2 shows the sample characteristics for the total group and broken down by diagnostic group. The three groups showed similar ages, gender distribution, depression characteristics and anxiety. In total, 9.7% (95%CI: 5.4, 14.0) of the sample reported pMDD and 2.2% (95%CI: 0.0, 4.3) reported suicidal ideation. A total of 14.5% (95%CI: 9.4, 19.6) had pGAD, with 5.3% (95%CI: 2.1, 8.6) reporting severe symptoms (GAD7 score >15). Total prevalence of pMDD and/or pMGAD was 17.7%.

Of the first 20 YP who screened positive for depression or anxiety, 50% were already known to the CP or a mental health service. Based upon the CP's clinical judgement, 18 out of the 20 cases were deemed to have been correctly identified as having anxiety and/or depression. The remaining two were considered to be false positives. These impressions

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were based either on clinical interviews or by reviewing documentation from local mental health services.

Preliminary analyses revealed a significant association between gender and anxiety, with a significantly higher proportion of females reporting pGAD in comparison to males (20.4% vs 8.0%, p=0.02). There was no association between gender and depression (males = 6.8% vs females = 12.2%, p=0.28). There was a significant association between age and anxiety, with higher age relating to increased anxiety severity (r=0.21, p=0.004), however age was not associated with depression severity (r=0.08, p=0.27).

In comparison to patients with "other" liver diseases, YP with LT and AILD reported significantly higher levels of psychological distress, rated on a 0-10 visual analogue scale: the mean ranks for psychological distress in LT, AILD and "other" patients are 4649.0, 6844.5 and 5159.5 respectively, with a Kruskall-Wallis chi-square test showing significance beyond the 0.05 level: $x^2(2) = 8.3$, p=0.02. Patients in the "other" group had significantly higher levels of suicidal ideation: $x^2(2) = 7.4$, p=0.02. The four patients reporting suicidal ideation were females aged 16-20 years old who all had long-standing mental health problems for which they were being treated by local mental health services.

Areas of specific psychological distress

The psychological distress thermometer identified specific areas causing distress to YP. There were no significant differences between the three treatment groups (Figure 2).

The six most commonly-reported areas of distress across the overall sample were fatigue (42.3%), money (30.8%), feeling worried (30.2%), concerns about work/school (29.1%), not

feeling good about themselves (27.5%), and sleep (27.5%). The top six reported worries varied slightly across the three illness groups (Table 3).

Associations with illness perceptions

Table 4 shows the illness perceptions associated with increasing severity of depression and anxiety. Higher levels of depression were associated with increased anxiety severity (r=0.59, p<0.001), increased perceptions of illness consequences (r=0.37, p<0.001), a reduced perception of personal control (r=-0.17, p=0.02), increased perceptions of illness identity (r=0.40, p<0.001), concern (r=0.38, p<0.001) and emotional response (r=0.50, p<0.001). Increased levels of anxiety were associated with increased perceptions of illness consequences (r=0.44, p<0.001) and timeline (r=0.15, p=0.04), a reduced perception of personal control (r=-0.17, p=0.02), increased perceptions of illness identity (r=0.49, p<0.001), concern (r=0.45, p<0.001) and emotional response (r=0.53, p<0.001). Neither anxiety (r= -0.14, p=0.07) nor depression (r=0.06, p=0.43) were associated with perceived understanding of illness or treatment control. Neither gender nor age were associated with illness perceptions.

Discussion

This is the first large cohort study to investigate the rate of anxiety and depression in YP post LT and to compare them with YP with AILD and other chronic liver conditions. As this data was collected as part of routine practice, the opt-in rate is much higher than might otherwise be expected (82%) and is likely to have improved the representativeness of the sample and generalizability of the findings. Using the PHQ9 and GAD7 17.7% of YP screened positive for anxiety or depression, without any differences between the three illness groups. This is higher compared to the estimated 4-6% (males and females respectively) in the general adolescent population, holding in mind that different measurement methods and participant age range were used (3). Four participants reported suicidal ideation. As suicide is the

leading cause of death amongst young men in the UK (26), it is essential that this risk is identified and ameliorated with evidence-based interventions.

There were strong associations between participants' perceived emotional impact of the illness (Emotional Response) and both depression and anxiety, and medium associations between how concerned YP were about their illness (Concern), how many symptoms they experienced (Identity), and how much impact they felt the illness had on their life (Consequences) with both anxiety and depression. This indicates that YP's mood difficulties are intertwined with their illness rather than merely co-existing, and that their beliefs about their illness/treatment should be targeted as part of routine care rather than treating the mental health problems in isolation from their liver care. Given previous research findings, it is reasonable to hypothesize that these beliefs and mental health problems might also interact with (non)adherence (12). As these are correlations, it is unclear whether depression/anxiety influences YP's perception of their illness, or whether negative beliefs about illness and treatment are directly contributing to their mood difficulties, or indeed both.

The lack of association between both participants' perceived understanding of their illness and their beliefs as to how much treatment can help (treatment control) with depression/ anxiety is also interesting. Transition care emphasises the need for education about condition and treatment, with an assumption that this improves self-management skills. Here YP reported that their understanding of illness did not impact on their level of distress, suggesting that their concerns are not related to a lack of knowledge, but more with their illness beliefs. Effective education should therefore target individuals' specific illness beliefs.

The factors that YP attribute their distress clustered under psychological stresses, physical complaints and practical stressors. Psychological stresses included worry (30%) and low

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self-esteem (27.5%). Amongst physical complaints, almost half of participants cited fatigue. Nearly a third of participants also cited sleep difficulties, allowing speculation as to whether the levels of fatigue reported are an inevitable symptom of these conditions or whether some of the fatigue experienced may be mediated by poor sleep habits. Sleep difficulties have been identified previously as one of the most distressing symptoms for adolescents with LT, and are negatively correlated with health-related quality of life (HRQOL) in both children (27) and adolescents (28). Fatigue in LT is reported to have a negative impact on relationships, due to the adjustments adolescents needs to make in their life (29). Amongst adolescents with AILD fatigue has been negatively associated with HRQOL (30). Psychological interventions for sleep problems are highly effective (31-32) and should be evaluated for this population as a priority.

Medication was a concern for those with AILD in particular, which would be highly pertinent to explore in the context of NA. Practical stresses also scored highly, including financial concerns in 30% of the sample, problems with school/employment in 29% and relationship difficulties in the LT (27%) and AILD (33%) groups in particular. This echoes findings from qualitative studies that, despite striving for normality, the transplant was perceived to have a negative impact on their schooling in adolescence (29) and on relationships in young adulthood (33). Similarly, in adolescents with AILD, physical symptoms were associated with poorer school performance (30). The potential interaction of these concerns should not be underestimated, as sleeping problems and fatigue could interfere with school and work performance and lead to financial concerns. Occupational functioning is a concern in the LT setting with unemployment rates of 50% in adults post LT and of 20% in young adults who were transplanted in childhood (34-35). In a recent study of 36 patients aged 16-35 years old post-LT for biliary atresia, 22% were unemployed at the time of their last follow up (36), this being considerably higher than the UK unemployment rate in YP of 13.7% (37). As this study was conducted in the UK, medications were provided on prescription through the national

health service (NHS) and so financial factors are unlikely to be a barrier to adherence to medication. However this should be explored in other countries where costs may have an impact.

The above concerns should be pre-empted and taken seriously by clinicians within the routine clinic review, both to engage the YP in discussing their most pertinent concerns and to facilitate appropriate onward referrals. As most of the concerns raised (including anxiety and depression) are amendable to intervention, this could dramatically improve patient care and optimise YP's health, wellbeing and educational/occupational outcomes. Routine integration of screening questionnaires within clinical practice is an easy and effective way of identifying these common mental health problems and illness beliefs. Some problems may require referral onto a specialist, but others may be amendable to intervention within the consultation; for example, by writing support letters to school, discussing concerns about side-effects, and advising on sleep hygiene strategies.

Psychosocial distress has been correlated with NA in both adolescents (11) and YP (12), and so addressing these issues is likely to also impact on physical health outcomes. Targeting interventions to illness beliefs have been shown to improve adherence (38), even when delivered in low-intensity protocol. For example, an 18-week intervention for young adults with asthma delivered through text-messages targeted at their specific illness beliefs significantly improved both participants' beliefs about their illness and treatment and their adherence rates as compared with controls (39). The findings of this research will help to inform the development of such targeted interventions for this population.

There are number of limitations of this study. Presence of anxiety or depression was based upon robust self-report measures. A clinical psychologist's judgement agreed with 18 out of

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the first 20 positive screens, but this was not validated with a standardised diagnostic interview. As data was collected as part of routine practice and participants were aware that their clinician would see their responses, this has the potential to influence their honesty of reporting – although would be more likely to result in under- rather than over-reporting of difficulties. Furthermore, this enabled recruitment of a more representative sample, as well as providing participants with direct input for their identified difficulties as part of their clinical care.

Particular strengths of the study include the large sample size, comparisons across three pertinent liver diagnostic groups, use of robust standardized measures, and enabling themes that have been identified in small sample qualitative research to be quantified and statistically correlated with clinical levels of psychopathology. In addition, this study focused on YP aged 16-25 (rather than younger adolescents), which has been shown to be a particularly vulnerable but under researched group.

In conclusion, our data demonstrates that there is a high level of anxiety and depression amongst YP with chronic liver disease and LT. Both anxiety and depression were strongly associated with YP's beliefs about their illness and treatment. There are a wide range of factors that YP attribute this distress to, most of which are amendable to psychosocial interventions. Enquiry into YP's psychosocial circumstances should be included within routine liver care. Focus should be expanded beyond transplant populations to include YP with chronic conditions which can result in transplantation if poorly controlled, as they report similar level of difficulties and areas of concern. Further studies are needed to elucidate how distress is associated with adherence with medication and engagement with services, as well as intervention studies to evaluate the effectiveness of approaches in reducing the identified sleep difficulties, mental health problems and addressing illness beliefs.

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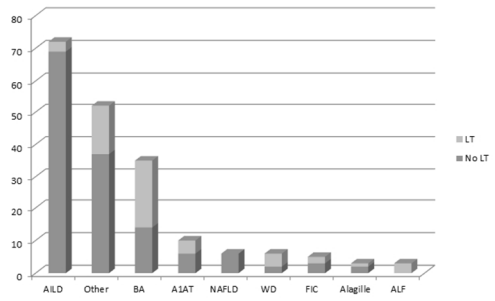

Figure 1 Diagnosis of underlying liver disease. Legend: AILD (autoimmune liver disease)n =72, others n=52, BA (biliary atresia) n=35, A1AT (alpha-1-antitrypsin deficiency) n=10, NAFLD (non-alcoholic fatty liver disease) n=6, WD (Wilson disease) n=6, FIC (familial intrahepatic cholestasis) n=5, Alagille (Alagille syndrome) n=3, ALF (seronegative acute liver failure) n=3

108x60mm (300 x 300 DPI)

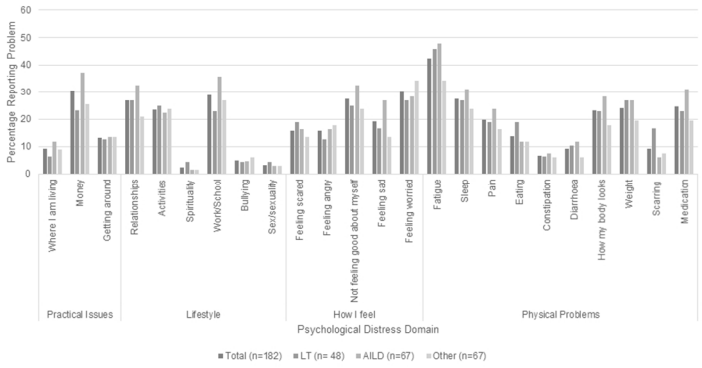

Figure 2. Percentage of patients responding "Yes" to psychological distress items

108x60mm (300 x 300 DPI)

Table 1. Demographic and clinical differences between screened and non-screened patients.

	Not screened (N=41)	Screened (N=187)	p
Age, mean (SD)*	17.8 (2.3)	18.1 (1.9)	0.40
Female gender, n (%)**	18 (43.9)	98 (52.4)	0.32
Liver transplanted, n(%)**	7 (18.0)	51 (27.3)	0.23
Bilirubin, median (IQR)^	12.0 (9.0-22.0)	11.0 (8.0-19.0)	0.45
AST, median (IQR)^	28.0 (22.0-45.0)	31.0 (23.0-53.0)	0.38
ALT, median (IQR)^	28.5 (21.0-57.0)	31.5 (19.0-67.0)	0.62

*p-value represents t-test of between-group differences. ** p-value represents chi-squared test. ^ p-value represents Mann-Whitney U test of between group difference in non-parametric data

Table 2. Sample characteristics and prevalence of mental health problems in LT, AILD and other liver disease patients.

Variable	All n = 187	LT n = 51	AILD n = 69	Other n = 67	p-value
Age, m(sd)	18.0 (1.7)	18.1 (1.5)	18.0 (1.8)	18.0 (1.7)	0.96
Female gender, n(%)	99 (52.9)	27 (52.9)	38 (55.1)	34 (50.8)	0.88
Psychological distress*, median(IQR)	**2.0 (0.0-5.0)**	**2.5 (0.0-6.0)**	**3.0 (0.0-6.0)**	**0.0 (0.0-4.0)**	**0.02**
PHQ9 depression status					0.84
No symptoms, n(%)	145 (78.0)	39 (76.5)	56 (81.2)	50 (75.8)	
Some symptoms, n(%)	23 (12.4)	7 (13.7)	6 (8.7)	10 (15.2)	
pMDD, n(%)	18 (9.7)	5 (9.8)	7 (10.1)	6 (9.1)	
pMDD severity					0.63
Mild pMDD (PHQ9<15)	6 (3.2)	3 (5.9)	2 (2.9)	1 (1.5)	
Moderate pMDD (PHQ9 15-19)	7 (3.8)	1 (2.0)	4 (5.8)	2 (3.0)	
Severe pMDD (PHQ9>19)	5 (2.7)	1 (2.0)	1 (1.5)	3 (4.6)	
Suicidal Ideation, n(%)	**4 (2.2)**	**0 (0.0)**	**0 (0.0)**	**4 (6.1)**	**0.02**
GAD7 anxiety status					0.11
No symptoms, n(%)	146 (78.5)	39 (76.5)	52 (75.4)	55 (83.3)	
Some symptoms, n(%)	13 (7.0)	3 (5.9)	9 (13.0)	1 (1.5)	
pGAD, n(%)	27 (14.5)	9 (17.7)	8 (11.6)	10 (15.2)	
Severe GAD (GAD7>15)	10 (5.4)	3 (5.9)	2 (2.9)	5 (7.6)	0.48
pMDD and pGAD	12 (6.5)	3 (5.9)	3 (4.4)	6 (9.1)	0.52
pMDD and/or pGAD	33 (17.7)	11 (21.6)	12 (17.4)	10 (15.5)	0.66
ALT, median(IQR)	31.5 (13.0-67.0)	29.0 (18.0-97.0)	34.0 (18.0-97.0)	39.0 (21.0-67.0)	0.38
AST, median (IQR)	31.0 (23.0-53.0)	28.0 (22.0-43.0)	31.5 (23.0-97.0)	34.0 (23.0,51.5)	0.16
Tacrolimus, median (IQR)^	3.4 (2.0-4.8)	3.5 (2.5-5.5)	1.6 (1.0-3.4)	-	0.89

*Psychological distress measured via distress thermometer scale 0-10. LT post-liver transplant; AILD Autoimmune Liver Disease; pMDD probable major depressive disorder; pGAD probable Generalised Anxiety Disorder. Bold text denotes statistically significant between-group difference. ^available in 36 (19.3%) patients overall: 31 (60.8%) of LT patients; 4 (5.8%) of AILD patients; and 1 (1.5%) of Other patients.

Table 3. Frequency of reporting areas of distress according to disease group.

Overall (N=182)			LT (N=48)			AILD (N=67)			Other (N=67)		
Domain	**N**	**%**	**Domain**	**N**	**%**	**Domain**	**N**	**%**	**Domain**	**N**	**%**
Fatigue	77	42.3	Fatigue	22	45.8	Fatigue	32	47.8	Fatigue	23	34.3
Money	56	30.8	Money	14	29.2	Money	25	37.3	Feeling worried	23	34.3
Feeling worried	55	30.2	Feeling worried	13	27.1	Work/School	24	35.8	Work/School	18	26.9
Work/School	53	29.1	Relationships	13	27.1	Not feeling good about myself	22	32.8	Money	17	25.4
Not feeling good about myself	50	27.5	Sleep	13	27.1	Relationships	22	32.8	Activities	16	23.9
Sleep	50	27.5	Weight	13	27.1	Medication	21	31.3	Not feeling good about myself	16	23.9

Table 4. Pairwise correlations between mental health and illness perceptions, showing correlation coefficients (r).

	Depression	Anxiety	Conseqs	Timeline	Pers cont	Treat contr	Identity	Concern	Underst
Consequences									
How much does your illness affect your life?	0.37***	0.44***	-						
Timeline									
How long do you think your illness will continue?	0.07	0.15*	0.23**	-					
Personal control									
How much control do you feel you have over your illness?	-0.17*	-0.17*	-0.31***	-0.02	-				
Treatment control									
How much do you think your treatment can help your illness?	-0.04	-0.07	0.04	0.11	0.25**	-			
Identity									
How much do you experience symptoms from your illness?	0.40***	0.49***	0.59***	0.12	-0.14	0.01	-		
Concern									
How concerned are you about your illness?	0.39***	0.45***	0.67***	0.09	-0.32***	-0.06	0.60***	-	
Understanding									
How well do you feel you understand your illness?	0.06	-0.14	-0.01	-0.07	0.23**	0.21**	-0.04	-0.06	-
Emotional response									
How much does your illness affect you emotionally?	0.50***	0.53***	0.67***	0.18*	-0.27***	-0.00	0.63***	0.73***	0.03

*p<0.05, **p<0.01, ***p<0.001.